A PROSPECTIVE STUDY COMPARING THE EARLY FUNCTIONAL OUTCOME AND GAIT BETWEEN LATERAL AND POSTERIOR APPROACHES IN TOTAL HIP ARTHROPLASTY

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A dissertation submitted to the Tamil Nadu Dr.M.G.R Medical University in partial fulfillment of the requirement for the award of M.S Branch II (Orthopaedic Surgery) degree March 2006-2008

CERTIFICATE

This is to certify that this dissertation titled **"A PROSPECTIVE STUDY COMPARING THE EARLY FUNCTIONAL OUTCOME AND GAIT BETWEEN LATERAL AND POSTERIOR APPROACHES IN TOTAL HIP ARTHROPLASTY"** is a bonafide work done by **Dr. G.GOPISANKAR @ BALAJI,** under my supervision and guidance, in the Department of Orthopaedic Surgery, Christian Medical College and Hospital, Vellore during the period from March 2006 – February 2008, in partial fulfillment of the rules and regulations of the Tamil Nadu Dr. M.G.R. Medical University for the award of M.S. Degree Branch-II (Orthopaedic Surgery).

This consolidate report presented herein is based on bonafide cases and studied by the candidate himself.

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INTRODUCTION :

Total hip replacement refers to replacement of a diseased hip joint with an artificial acetabulum and head of femur. It is indicated for arthritis of the hip joint, which usually leads to increase in pain, deteriorating gait and stiffness. Currently it is the procedure of choice for most hip conditions. The extraordinary success of total hip replacements has led to a progressive increase in the number of replacement surgeries done. The clinical research towards various components of hip replacement has led to rapid developments but the choice of approach remains surgeon dictated.

The primary aim of total hip arthroplasty is to create a stable, functional and painless hip. The success of total hip arthroplasty depends on the ability of the surgeon to achieve adequate surgical exposure while minimizing complications so as to achieve optimal implant position. There is a difference of opinion among orthopaedic surgeons regarding the best surgical approach for total hip replacement. The proponents of the posterior approach claim better exposure, less blood loss and easy implant positioning without abductor damage but the proponents of lateral approach site a higher rate of dislocation in posterior approach.

Today, the most commonly performed approaches to total hip arthroplasty include the abductor muscle splitting lateral approach and the posterior approach.

AIMS AND OBJECTIVES :

The Objectives of the present study done in the Department of Orthopaedics, Christian Medical College and Hospital, Vellore are to compare

1.Functional outcome

2. Gait

3.Trendelenburg test

4. Gluteus Medius and Maximus function using Electromyography,

between lateral and posterior approaches for primary total hip replacement.

APPLIED ANATOMY :

The hip joint is designed for both mobility and stability, allowing the entire lower extremity to move in three planes of motion. The hip provides an important shock absorption function to the torso and upper body as well as stability during standing and other weight-bearing activities.

The hip is actually a ball and socket joint, uniting two separate bones – the femur with the pelvis. The pelvis features two cup-shaped depressions called the acetabulum, one on either side of the body. The head of the femur, shaped like a ball, fits tightly into the socket, forming the ball and socket joint of the hip, allowing the leg to move forward and backward and side to side, and rotate right and left.

The acetabulum is at the confluence of ischium,ilium and pubis.It is formed from ossification of the triradiate cartilage during development .It is lined with cartilage except inferiorly, which cushions the bones during weight-bearing activities and allows the joint to rotate smoothly and freely in all planes of movement with minimal friction. The weight bearing upper posterior wall of the acetabulum is especially heavy ,whereas the anterior wall is usually less developed. The acetabular fossa located at the centre of the acetabulum is the thinnest portion of the floor of the acetabulum. Beyond this area damage may be rendered if acetabulum is deepened. In the osteoarthritic hip ,this area is thickened and further deepening is possible here. The acetabulum is deepened by the fibrocartilagenous labrum attached to its rim.

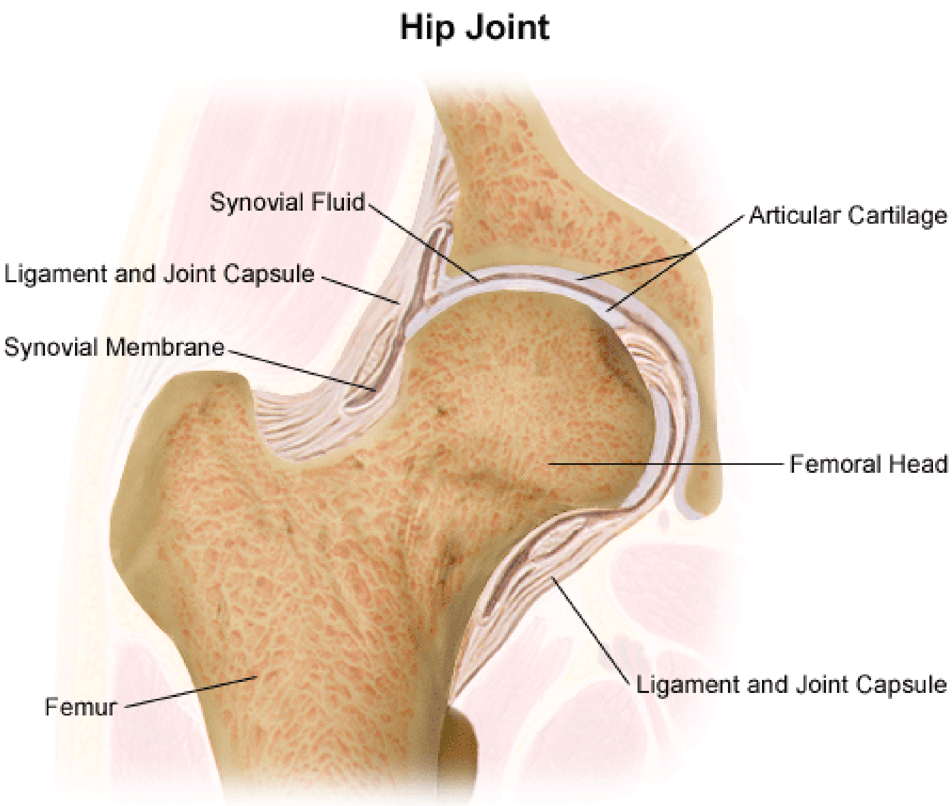
The complex system of ligaments that connects the thigh bone to the pelvis is essential for stability, keeping the hip from moving outside of its normal planes of movement.

The muscles of the hip joint have dual responsibilities, working synergistically to provide the power for the hip to move in all directions, as well as to stabilize the entire lower extremity during weight-bearing activities.

The Gluteus maximus originates from posterior iliac crest and inserts on the fascia lata and posterior proximal femur. The Gluteus medius and gluteus minimus are broad fan–shaped muscles that originate from the lateral iliac wing and insert onto the greater trochanter. Together, these muscles abduct the hip and prevent lateral sway of the trunk during gait.

A knowledge of the gross anatomy of the hip is of paramount importance for the surgical approach and the technique in relation to orientation and insertion of the prosthetic components.

FIGURE 1



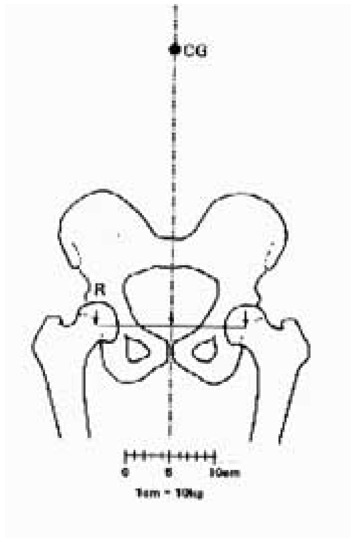
ANATOMY

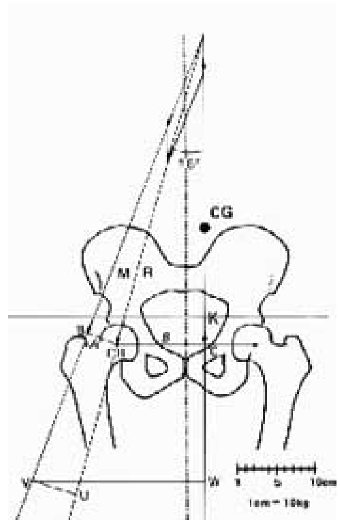
BIOMECHANICS :

It is important to know the biomechanics of the hip joint as the factors which affect the hip must be understood to prevent the complication and further deterioration of the hip joint.

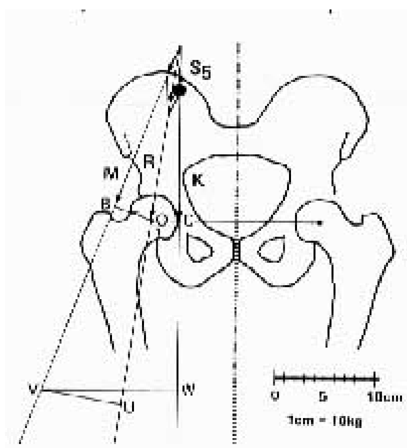
To describe the forces acting on the hip joint, the body weight can be depicted as a load applied to a lever arm extending from the body's center of gravity to the center of the femoral head. The abductor musculature, acting on a lever arm extending from the lateral aspect of the greater trochanter to the center of the femoral head, must exert an equal moment to hold the pelvis level when in a one-legged stance, and a greater moment to tilt the pelvis to the same side when walking or running. Since the ratio of the length of the lever arm of the body weight to that of the abductor musculature is about 2.5: 1, the force of the abductor muscles must approximate 2.5 times the body weight to maintain the pelvis level when standing on one leg. The estimated load on the femoral head in the stance phase of gait is equal to the sum of the forces created by the abductors and the body weight and is at least 3 times the body weight; the load on the head during straight leg raising is estimated to be about the same. [4,6,33-34]

FIGURE 2





2 Legged Stance Single Stance



Forces on the hip with sideways limping

BIOMECHANICS OF HIP

The forces on the joint act not only in the coronal plane, but because the body's center of gravity (in the midline anterior to the second sacral vertebral body) is posterior to the axis of the joint, they also act in the sagittal plane to bend the stem posteriorly. The forces acting in this direction are increased when the loaded hip is flexed, as when arising from a chair, ascending and descending stairs or an incline, or lifting. During the gait cycle, forces are directed against the prosthetic femoral head from a polar angle between 15 and 25 degrees anterior to the sagittal plane of the prosthesis. During stair climbing and straight leg raising, the resultant force is applied at a point even farther anterior on the head. Such forces cause posterior deflection or retroversion of the femoral component.

Hip joint stress may be reduced by changes in the mechanism of the joint, such as leaning on the affected side, increasing the weight-bearing surface of the joint and decreased weight of the patient. Another method of altering the mechanism is the use of a cane on the opposite side.

The total hip prosthesis is expected to perform a mechanical function by transmission of weight load and also transmission of motion.

Not only must low frictional resistance be maintained between a joint but also the torsional force transmitted from the prosthetic femoral head to the socket must be resisted for a successful arthroplasty.

Total hip components withstand many years of cyclic loading equal to at least 3 to 5 times of body weight and at times 10 to 12 times while jogging and running. Increased body weight, increased physical activity add to loosening, hence hip replacement patient should not do these activities.

GAIT :

Human gait is bipedal, biphasic, forward propulsion of centre of gravity, in which there is alternate sinuous movement of head and body, with least expenditure of energy.

Normal walking requirements are

1. Equilibrium-ability to assume upright posture and maintain balance.
2. Locomotion-ability to initiate and maintain rhythmic stepping.
3. Musculoskeletal integrity-normal bone joint and muscle function.
4. Neurological control-visual, auditory vestibular and sensory motor input

GAIT ANALYSIS:

Gait analysis is a Study of human locomotion. Walking consists of a series of gait cycles .A single gait cycle is known as a STRIDE.

GAIT CYCLE:

A single gait cycle or stride is defined as a period when one foot contacts the ground to when that same foot contacts the ground again

Each stride has 2 phases - the Stance Phase which occupies 60% of the gait cycle and the Swing Phase which occupies 40% of the gait cycle.

STANCE PHASE OF GAIT :

When the foot is in contact with the ground .

Stance phase has 5 parts: 1.Initial Contact (Heel Strike) 2.Loading Response (Foot Flat) 3.Midstance 4.Terminalstance (heel raise) 5.Pre-Swing (toe off)

SWING PHASE:

When the foot is not contacting the ground. It is the Limb advancement phase. 3 parts of swing phase are: Initial swing , Midswing and Terminal swing.

GAIT PARAMETERS:

Step length –Distance between two feet during double limb support.

It is measured from the heel of one foot to heel of contralateral foot

Stride length -distance one limb travels during the stance and swing phase.

It is measured from the point of foot contact at the beginning of stance phase to the point of contact by the same foot at the end of swing phase

gait parameters.

Step time –Amount of time used to complete one-step length

Cadence –Number of steps taken per minute

Walking velocity -Distance travelled per minute

Actions of the Hip Joint During Gait

Acceleration and Heel Strike:

Restraining the forward movement of the lower limb occurs during this interval through the eccentric contractions of hamstring and gluteus maximus muscles acting on the hip joint. This restraining action leaves the hip in a flexed position.

The gluteus medius and gluteus minimus contract concentricly abducting the reference limb from a weight bearing position. This involves moving the iliac crest of the reference limb away from the midline (abduction). The iliac crest moves instead of the femur because at heel strike, the foot of the reference limb is in contact with the ground and in a weight bearing position. The femur can not move so the muscles act on the iliac crest which can move. Concomitantly, the non weight bearing hip is "hiked" upward counterbalancing the effect that gravity wants to exert on the non reference limb which is about to attain a non weight bearing position . Without the concentric contraction of the hip abductors on the weight bearing reference limb, the opposite hip would tilt downward making it very difficult to swing the limb forward in order to take a step. This type of gait is called "Trendelenburg Gait"

Heel Strike to Mid-stance:

The torso is being pulled over the center of the reference limb as the non-reference limb swings forward. This puts the hip in a neutral position without any direct actions of muscles acting on the hip.

Mid-stance to Toe Off:

The non-reference limb is in a non weight bearing stage and is swinging forward as a step is taken. This process "drags" the torso in front of the reference limb forcing the hip joint of the weight bearing reference limb into an extended position. Once again, this occurs without the direct action of the muscles acting on the reference limb.

Toe Off to Acceleration :

During this interval, the reference limb goes from a weight bearing to a non-weight bearing position as the reference limb begins to swing forward ahead of the torso as a step is being taken. Powerful concentric contractions of the hip flexors, mainly the iliopsoas muscle with help from the adductor muscles bring the hip into a position of flexion. The hip adductors also help the swinging limb move in an inward direction. This enables the foot to be placed under the pelvis rather than in a position that would be parallel with the shoulder.

MUSCLE ACTIVITY DURING GAIT

INTERVAL	JOINT	POSITION	MUSCLE ACTIVITY
Acceleration to Heel Strike	Hip	Flexed	Gluteus Maximus Hamstrings Gluteus medius & minimus
	Knee	Flexed	Quadriceps femoris
	Ankle	Neutral	Anterior crural muscles
Heel Strike to Midstance	Hip	Neutral	Gluteus medius & minimus
	Knee	Extended	Quadriceps femoris
	Ankle	Dorsiflexed	Gastrocnemius; soleus
	Tarsal	Inverted	Tibialis anterior Tibialis posterior

Midstance to Toe Off	Hip	Extended	-
	Knee	Flexed	Gastrocnemius
	Ankle	Plantar flexed	Gastrocnemius; soleus
	Tarsal	Everted	Peroneus longus Peroneus brevis
Toe Off to Acceleration	Hip	Flexed	Iliopsoas Adductors longus, brevis, magnus
	Knee	Flexed	Gastrocnemius
	Ankle	Neutral	Anterior crural muscles
	Tarsal	Neutral	-

Some types of Pathological gait are - Spastic gait, antalgic gait, Trendelenberg gait, Shortlimb gait, Gluteus maximus gait, Waddling gait etc. .

REVIEW OF LITERATURE :

Carnochan was the first surgeon, who thought that hip joint could also be replaced artificially in 1840. Dr.Marius N Smith-Petersen[39,40] from Boston introduced the mould arthroplasty in 1925. He used a reactive synovial like membrane that he found around a piece of glass in a workman's backyard. Dr. Jean Judet and his brother, Dr. Robert Judet [18] (1938) of Paris, attempted to use an acrylic material to replace arthritic hip surfaces.

The first reported Total hip replacement was done in Germany in 1890 by Gluck using ivory ball and socket joint.In 1919, Delbet used a rubber femoral head to treat femoral neck fractures.Phillip Wiles (1938) performed the first hip arthroplasty.McKee and Farrar[28] of Norwich, used a total hip prosthesis with a metal acetabular cup and the Thompson prosthesis of chromium alloy in 1951. In 1966, Ring[36] used a prosthesis, which consisted of a metal acetabular cup, which was screwed into the pelvis.

By the early 1960s the complications of infections, loosening, poor metallurgy and foreign body reactions were clearly demarcated.

The true revolution for these came in 1958, when Charnley[5,6] aggressively pursued effective methods of replacing both the femoral head and acetabulum of the hip and he developed a conceptual low friction arthroplasty after analysing animal joint lubrication.

An integral part of Charnley's concept is – medialization of cup (centralization of head) and lateralization of trochanter, which increase the length of lever arm of abductor and thereby decreases the force acting on joint – which reduces friction and frictional torque and decreases the chances of wear and loosening . But due to his concept – subchondral bone at acetabulum is violated which has increased acetabular loosening.

The original Charnley[5,6] technique used the anterolateral surgical approach with the patient supine, osteotomy of the greater trochanter, and anterior dislocation of the hip. This approach is used much less commonly now as a result of problems related to reattachment of the greater trochanter. Amstutz advocated the anterolateral approach with osteotomy of the greater trochanter but with the patient in the lateral rather than supine position. The Muller technique also uses the anterolateral approach with the patient in the lateral position but includes release of only the anterior part of the abductor mechanism.

The role of trochanteric osteotomy in hip replacement is still a debate among some hip surgeons. Those who advocate trochanteric osteotomy argue that surgical exposure is unsurpassed. It is particularly useful in difficult primary arthroplasties such as acetabular protrusion, stiff hips, hip dysplasia, and posttraumatic cases, as well as in revision arthroplasties Furthermore, advancement of the abductor mechanism during trochanteric reattachment allows adjustment of soft tissue tension after Total Hip Arthroplasty, thereby avoiding instability.

The disadvantages of trochanteric osteotomy are increased operating time, greater blood loss, wound haematoma, delayed postoperative weight bearing, trochanteric bursitis, non union of trochanter and breakage of wire[30].

Numerous surgeons have modified the lateral approach. All modifications of this technique for Total Hip Arthroplasty have a common element: the hip is approached through the interval within the tensor fascia lata and the gluteus medius muscle, some portion of the abductor mechanism is released from the greater trochanter, and the femoral head is displaced anteriorly. The various anterolateral approaches differ in the technique recommended to mobilize the abductors from the greater trochanter.

In 1954 McFarland and Osborne [26]described a new surgical approach to the hip, which was based on their anatomical observation that the gluteus medius and vastus lateralis were in functional continuity through the thick tendinous periosteum covering the greater trochanter. The patient is placed on his side and the gluteus medius and vastus lateralis are detached from their posterior borders and the combined muscle swung forward like a bucket handle. This procedure normally involves detaching some spicules of bone or in some cases a thin shell of bone from the lateral aspect of the trochanter which is then taken forward.

Hardinge[15] in 1982 described a new surgical approach which takes advantage of the fact that the insertion of the gluteus medius to the greater trochanter is by a strong tendon which is wide in its anterior half. Incision is made in line with the fibers of the gluteus medius at the junction of the middle and posterior thirds of the muscle. Distally, the incision is made anteriorly in line with the fibers of the vastus lateralis down to bone along the anterolateral surface of the femur. The major change described by Hardinge[15] was to leave the posterior portion of the gluteus medius, with its thickest insertion point, undisturbed from the greater trochanter.

Residual abductor weakness and limp following this approach may be the result of avulsion of the repair of the anterior portion of the abductors or of direct injury to the superior gluteal nerve. The Dall[9] variation of this approach involves removal of the anterior portion of the abductors with an attached thin wafer of bone from the anterior edge of the greater trochanter to facilitate their later repair. Abductor function is better after bony reattachment of the anterior portions of these muscles.

Mallory Frndak[11] in 1993 modified the Hardinge[15] direct lateral approach by placing the abductor "split" more anterior, directly over the femoral head and neck.

Learmonth[21] in 1996 described a modified lateral approach to the hip which exploits the functional continuity of gluteus medius and vastus lateralis and their dense crescentic attachment to the greater trochanter. The gluteus medius is not incised or split, but is detached and mobilised with gluteus minimus as one unit. This facilitates reattachment of the glutei and helps to preserve abductor function.

In total hip replacement, the LATERAL approach with the patient in the supine position offers the following advantages

1. Orientation of the implant
2. Insertion of cement
3. Correction of the discrepancy in leg length.
4. Precise pelvic orientation

5. Improved access for anaesthesia personnel.

Disadvantages of the LATERAL approach are

1. Persistent postoperative limp
2. Risk of damage to superior gluteal nerve.

The anterolateral approach first described by Bardenhauer and later improved by Watson Jones[43] exposes the hip between the Gluteus medius and Tensor fascia lata interval. After incising the superior , anterior and inferior portions of capsule ,the hip is dislocated anteriorly. The anterolateral approach is not commonly used now.

The earliest account of a posterior exposure is that of von Langenbeck (1874). The gluteus maximus muscle was split in line with the fibers, in the direction of a line extending from the tip of the trochanter to the palpable posterior superior iliac spine.

The Langenbeck approach was modified by Kocher[20] (1907). All Kocher's incisions served the fundamental principle *primum non nocere;* they were designed to pass between adjacent nerve territories. In the hip joint the tissues were separated between the territories of the superior and inferior gluteal nerves-between the gluteus medius, gluteus minimus and tensor fasciae latae on the one hand and gluteus maximus on the other. He shifted the approach to anterior border of the greater trochanter and added a distal limb along the line of the shaft of the femur; the upper limb passed obliquely backwards towards the posterior superior spine along or near the upper border of the gluteus maximus. Kocher’s approach was designed to improve the exposure of the acetabulum for the treatment of tuberculosis.

Gibson[12] in 1950 modified Kocher’s approach. He improved the exposure of the hip by adding release of the two main abductors of the hip namely gluteus medius and minimus muscles.

Moore's[29] approach (1959) has been facetiously labeled "the southern exposure." He divided the Gluteus maximus fibres by blunt dissection and cut the short external rotators to expose the capsule. The Gluteus medius is not disturbed by this approach. This is the standard posterior approach most commonly used in practice.

The advantages of the posterior approach[13] are that it is rapid, almost bloodless and attended by little shock. The gluteus maximus and tensor fasciae latae, which are so important for stability of the hip, are not weakened and the operation causes no instability.

In posterior fracture-dislocations of the hip joint, direct exposure of the site of the injury is gained. When operation is required to secure replacement of a slipped upper femoral epiphysis the posterior part of the joint with the displaced epiphysis is exposed readily. The approach is ideal for exposure of the sciatic nerve in the buttock, and for dealing with injuries of the gluteal arteries. In arthrodesis of the hip joint the anterior flap may be retracted to allow access to the ilium, which may be required for use as a graft, and the field of implantation of the graft is displayed with the least possible trauma.

The disadvantages of posterior approach are

1. An increased incidence of posterior dislocation
2. A higher incidence of sciatic nerve palsy
3. Limb length equalization is difficult in lateral decubitus position.

The complications following total hip arthroplasty in relation to both approaches are

1. Nerve injuries – sciatic nerve injury is common in posterior approach whereas superior gluteal nerve injury may occur following lateral approach [37-38,42].
2. Heterotropic ossification- commoner with lateral approach when compared with posterior.
3. Dislocation – commoner with posterior approach when compared with lateral [37-38,42].

FEMORAL OFFSET:

Femoral offset is one of the parameters of the abductor moment arm that affects hip abductor muscle function. The advantages of increasing the abductor moment arm after total hip arthroplasty are well known. Many previous reports deal with the relationship between the abductor momentarm or femoral offset and other factors such as hip stability, range of motion,and abductor muscle strength after Total Hip Arthroplasty. Greater femoral offset would increase the abductor moment arm, and this increase would reduce the abductor force required for walking.

Femoral offset is defined as the perpendicular distance from the center of rotation of the femur (femoral head center) to the long axis of the femur . Charnley (1979) considered it to be a factor under the control of the surgeon at the time of hip replacement surgery; the more lateral position of the femur with greater offset was said to increase the range of motion and decrease the incidence of impingement of the femur on the pelvis. An increase in femoral offset (and consequently of the lever arm of the abductor muscles) will also,theoretically,increase the mechanical advantage and strength of the abductors. Finally, a greater femoral offset will increase stability by preventing impingement and improving soft tissue tension. The surgeon can obtain increased offset during surgery by selecting femoral prostheses that have increased offset and/or a varus prosthetic neck. Through proper implant reconstruction and restoring adequate femoral offset, surgeons can restore good biomechanical function of the hip[27].

TRENDELENBURG TEST :

Trendelenburg gait is a study of biomechanics and the gluteus medius and minumus muscles. In 1897 Friedrich Trendelenburg described a test which he found useful in determining the integrity of hip abductor muscle function, with specific reference to congenital dislocation of the hip and progressive muscular atrophy (Rang 1966).. The examiner stands behind the patient and observes the angle between the pelvis (the line joining the iliac crests) and the ground . Hardcastle and Nade[14] in 1985 described the various responses of Trendelenburg test.

Functional assessment of a joint is important in the clinical assessment of patients. Observation of gait is probably performed less often than is desirable because of limitation of space. The Trendelenburg test allows for functional assessment in a confined space, and is a more valuable clinical sign than many static tests.

In this study we used the response as classified by Dr.V.S.Pai[32] from New Zealand in 1996.

ELECTROPHYSIOLOGY:

Electromyography refers to recording of action potentials of muscle fibres firing singly or in groups near the needle electrode in a muscle .

Clinical electromyography consists of nerve conduction studies and needle electromyography. In the strict sense of the word, EMG only refers to the needle electrode examination of muscles, however is has traditionally been used to refer to both Nerve conduction study and needle EMG.

Needle EMG does not introduce any electrical stimulation, instead it records the intrinsic electrical activity of skeletal muscle fibers. The needle is quite slim (about a 25 gauge) and produces minor discomfort which most patients can tolerate. Needle EMG findings suggestive of denervation include:

1. fibrillations,
2. positive sharp waves, and
3. giant motor unit potentials (MUP)

Insertional activity: The response of the muscle fibers to needle electrode insertion is called the insertional activity. Normally it consists of brief, transient muscle action potentials in the form of spikes, lasting only a few seconds and stopping immediately when needle movements stop. Note that insertional activity may be decreased, such as in fibrosis or fat tissue replacement; or prolonged, such as in early denervation and in myotonic disorders.

Spontaneous activity: The persistence of any activity beyond insertion constitutes spontaneous activity. This could be due to the normal end-plate noise, or to the presence of fibrillations and positive waves, or other spontaneous activity.

The muscle at rest must be examined in four or five different directions once the needle is inserted to ensure adequate sampling. A pause of 0.5-1 second is required between each insertion to allow for the observation of any spontaneous activity. When fasciculations are suspected, this time is less than adequate and a 10 to 15 second pause is more appropriate.

Voluntary activity : Assess voluntary activity during three stages of effort: mild, moderate, and full. With mild and moderate voluntary effort, individual motor units can be studied separately and their amplitude, duration, and number of phases measured. Recruitment and firing rates are best assessed during moderate effort and the interference pattern during full effort[7].

MATERIALS AND METHODS :

A prospective study was done in patients undergoing total hip replacement from January 2007 to May 2007 in the Department of Orthopaedics in Christian Medical college which is a 2500 bedded multispeciality tertiary care teaching centre.

30 patients were included in the study. 7 patients had insufficient follow up evaluation and were excluded from the study after initial assessment.

23 patients were finally included in the study out of which 16 were male and 7 were females.

INCLUSION CRITERIA:

Any patient with hip arthritis or unstable hip with

1. Age more than 20 years (Skeletally mature)
2. Normal preoperative electromyography.

EXCLUSION CRITERIA :

1. Age less than 20 years and more than 80 years
2. Signs of abnormal nerve function
3. Dysplastic hip

4. Neurological disease or history of sciatica with neurological signs.

Diagnosis included chronic arthritis secondary to primary osteoarthritis (5), tuberculosis (1), avascular necrosis (8), inflammatory conditions namely Ankylosing spondylitis (5), Rheumatoid arthritis (1), and non union neck of femur (3).

13 patients underwent lateral muscle splitting approach and 10 underwent posterior gluteal splitting approach by 2 senior arthroplasty surgeons who have vast experience in the specific surgical approach they perform.

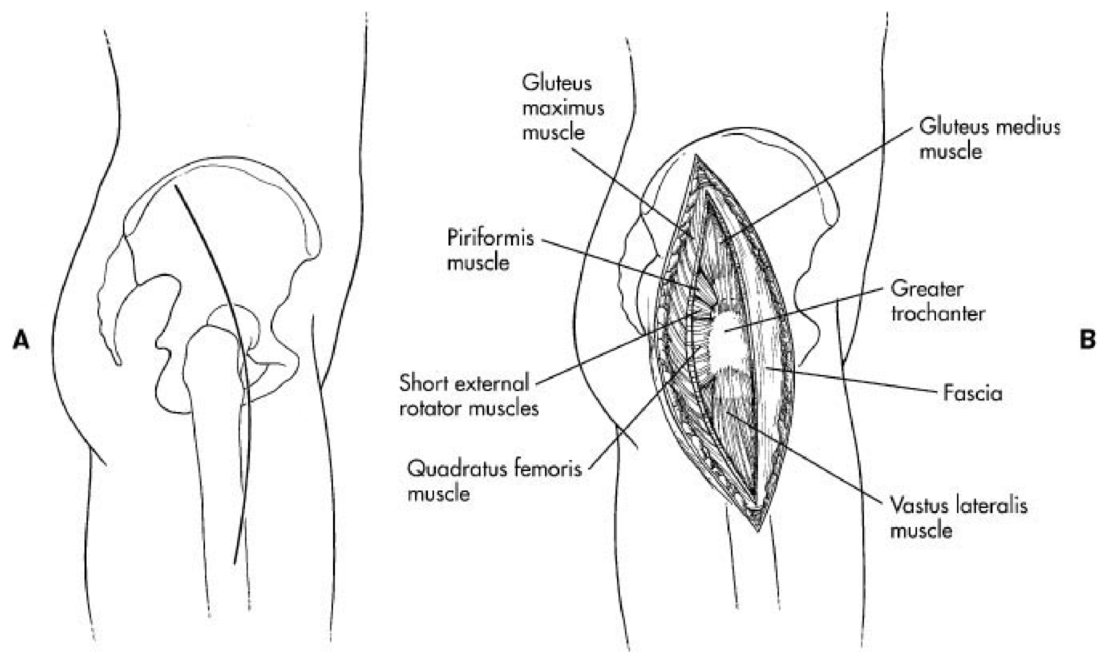
Those patients who were admitted in unit I underwent lateral approach and those who were admitted in unit III underwent posterior approach.

All of them were admitted in special rooms allocated for patients who are to undergo total hip replacement. A detailed history and clinical examination was done. Preoperative assessment of range of movements, pain, function, Trendelenburg test and EMG were done.

For the lateral approach the patient is positioned supine on a sand bag. The modified Hardinge[11] approach was used in all cases. Make a posteriorly directed lazy-J incision centered over the greater trochanter . Divide the fascia lata in line with the skin incision and centered over the greater trochanter. Retract the tensor fasciae latae anteriorly and the gluteus maximus posteriorly exposing the origin of the vastus lateralis and the insertion of the gluteus medius . Incise the tendon of the gluteus medius obliquely across the greater trochanter leaving the posterior half still attached to the trochanter. Carry the incision proximally in line with the fibers of the gluteus medius at the junction of the anterior and middle thirds of the muscle. Distally, carry the incision posteriorly in line with the fibers of the vastus lateralis down to bone along the anterolateral surface of the femur. Elevate the tendinous insertions of the anterior portions of the gluteus minimus and vastus lateralis muscles. Abduction of the thigh then exposes the anterior capsule of the hip joint. The Capsule is incised and hip dislocated. During closure, repair the tendon of the gluteus medius with nonabsorbable braided sutures.

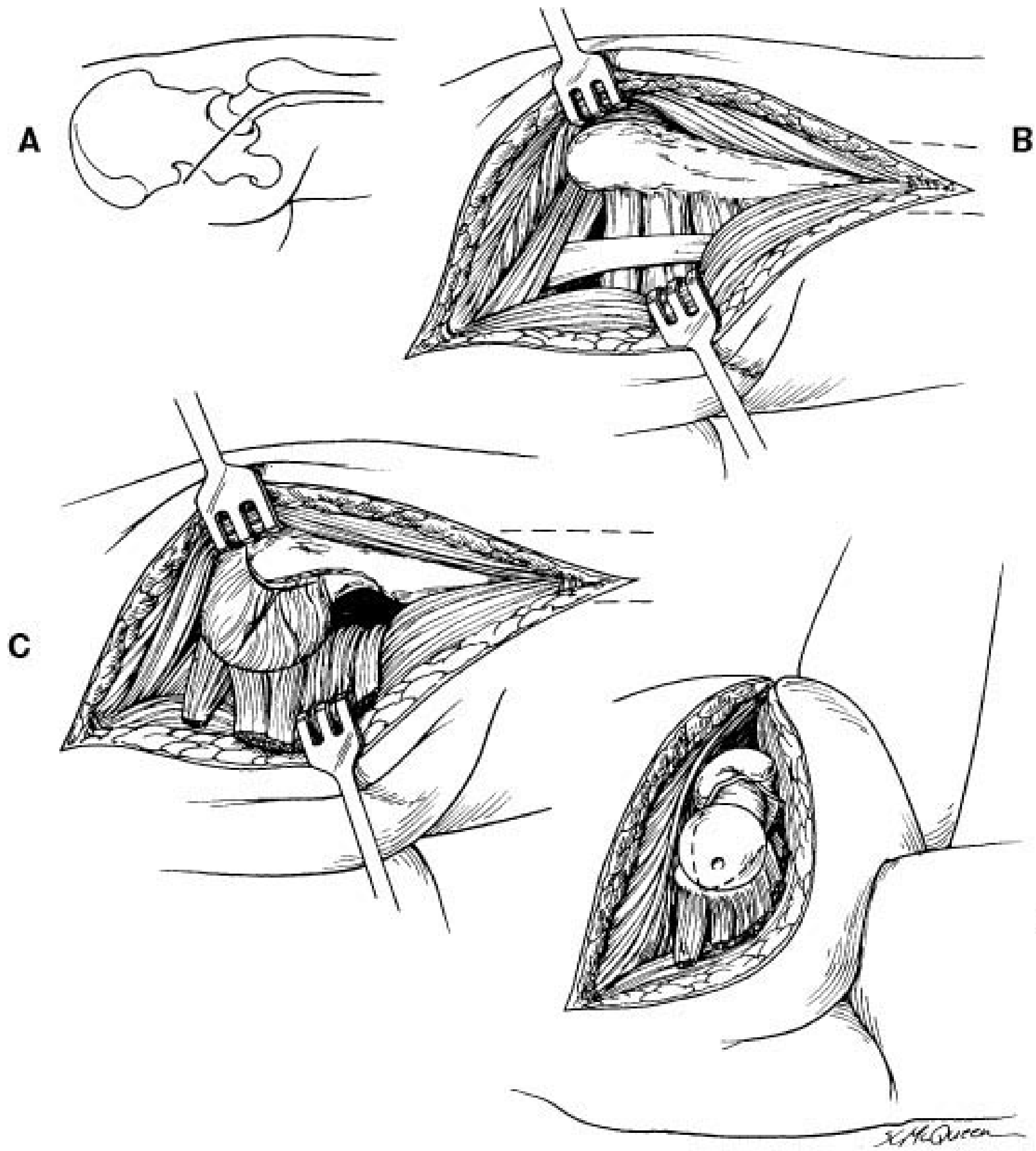
In Posterior[29] approach , the patient is placed on the unaffected side. Start the incision approximately 10 cm distal to the posterosuperior iliac spine and extend it distally and laterally parallel with the fibers of the gluteus maximus to the posterior margin of the greater trochanter. Then direct the incision distally 10 to 13 cm parallel with the femoral shaft. Expose and divide the deep fascia in line with the skin incision. By blunt dissection separate the fibers of the gluteus maximus; taking care not to disturb the superior gluteal vessels in the proximal part of the exposure. Retract the proximal fibers of the gluteus maximus proximally and

FIGURE 4



LATERAL APPROACH

FIGURE 5



POSTERIOR APPROACH

expose the greater trochanter. Retract the distal fibers distally and partially divide their insertion into the linea aspera in line with the distal part of the incision. Next, divide the short external rotators at their insertion on the femur and retract the muscles medially. The posterior part of the joint capsule is now well exposed; incise it from distal to proximal along the line of the femoral neck to the rim of the acetabulum. Flex the thigh and knee 90 degrees, internally rotate the thigh, and dislocate the hip posteriorly.

The femur and acetabulum are reamed to appropriate sizes and the prosthesis is inserted. The use of methylmethacrylate was left to the discretion of the individual surgeon. All patients were placed in an abductor pillow in the operating room. Beginning on the night of surgery, all patients received mechanical prophylaxis for thromboembolism in the form of ankle foot pump exercises and calf muscle squeezing. None of the patients received anticoagulants. Postoperatively, all patients followed a physical therapy regimen while in bed, including isometric knee extension and hip abduction, beginning on the first postoperative day. Ambulation also was permitted on the second postoperative Day after drain removal and radiograph. Patients treated with cemented arthroplasties were allowed full weight-bearing as tolerated with crutches, beginning on the second day after surgery. Patients treated with uncemented arthroplasties were allowed 10 % weight-bearing with crutches, beginning on the second postoperative day. Toe touch weight bearing was continued for six weeks and then progressed to full weight bearing in a gradual manner between six and 12 weeks. Compliance of patients was excellent in all groups.

All these patients were examined 3 months postoperatively for assessment.

The functional outcome of hip surgery is measured using Harris[16] Hip Score. It gives a maximum of 100 points.

The domains include pain (44 points), Function (47 points), Deformity(4 points) and Range of motion(5 points).

Function is subdivided into activities of daily living – 14 points and gait – 33 points.

A Score of 90-100 means excellent results, 80-90 being good, 70-79 fair, and below 70 poor. It is assessed before and after surgery to determine improvement.

Trendelenburg test was assessed preoperatively and postoperatively.

In this study we use the response as classified by Dr.V.S.Pai[32] from New Zealand in 1996. According to him , the response is classified as

1. Normal – if the pelvis on the non stance side can be elevated high up and is maintained for 30 seconds.
2. Elevation of the pelvis is present but not maximal
3. Pelvis is elevated but not maintained for 30 seconds
4. No elevation of the pelvis on the non stance side
5. Drooping of the pelvis
6. NON VALID response – presence of hip pain,uncooperative patient

In this study 1 and 2 were considered normal

Responses 3,4,5 and 6 were considered positive.

VISUAL GAIT ANALYSIS was assessed preoperatively and postoperatively using Rivermead visual gait analysis (RVGA) method described by S.E.Lord[22] et al from Rivermead rehabilitation centre, Oxford, UK IN 1998.

The RVGA comprises two observations of the arms covering both swing and stance of gait, and 18 observations of the trunk and lower limb: 11 observations during the stance phase and seven during the swing phase of gait. The observations apply only to one side at a time.

A four-point scale was used to quantify the degree of abnormality for each of the component items: 0 = normal, 1 = mild, 2 = moderate and 3 =

severe. A global score can be calculated by summing the total numbers of deviation scores, range from 0 (normal gait) to 59 (grossly abnormal gait) .

Patient is viewed from the front, side, and behind . The following are noted

1.The head position.

2.Shoulders - depressed, elevated, protracted, or retracted.

3.Amount of arm swing - normal, increased, or decreased

4.The trunk - forward or backward lurch or a list to the R or L

5.The pelvis -hiked, level, dropped, or fixed.

6.The hip - extension, flexion, rotation, circumduction, or an adducted or abducted posture.

7.The knee - flexion, extension, and general stability

8.The ankle- plantarflexion and dorsiflexion, eversion and inversion.

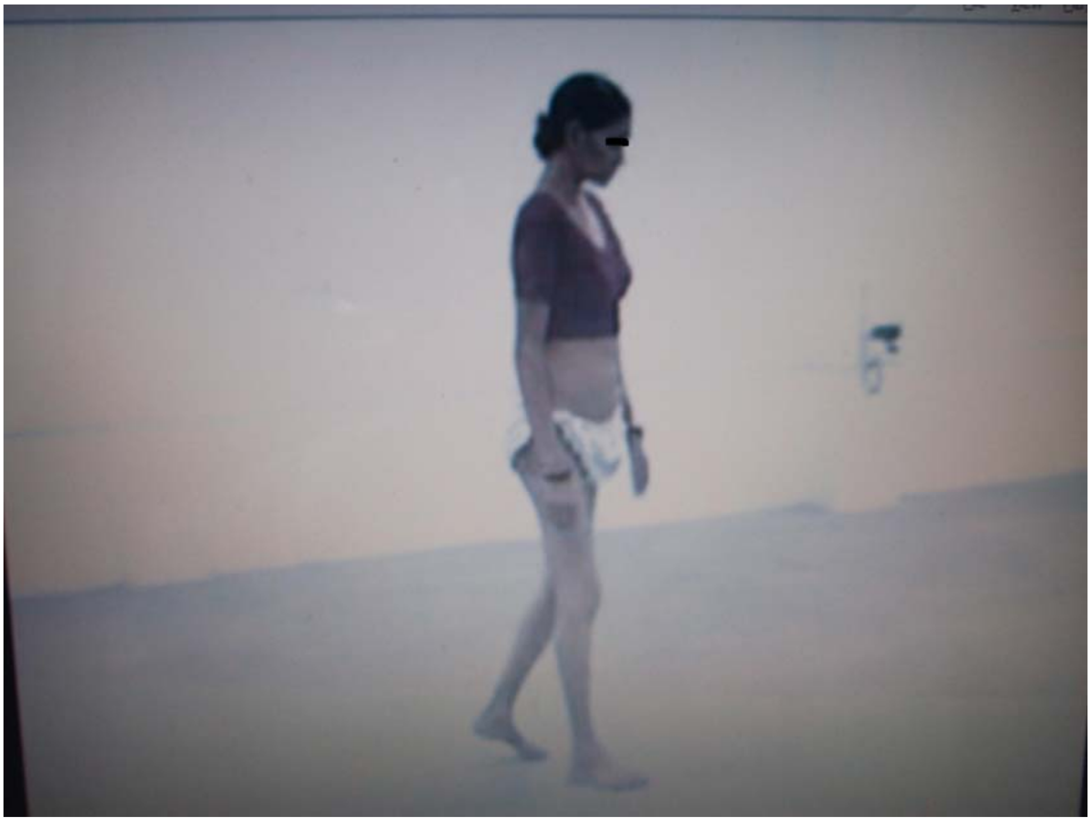
9.The foot - proper push off and pronation and supination .

In each case preoperative needle electromyographiy (EMG) was carried out to examine gluteus medius and gluteus maximus. EMGs were

FIGURE 6

Gait analysis – Postoperative

FIGURE 7



Postoperative Gait Analysis

carried out in the Physical Medicine and Rehabilitation department. The muscles were examined using the criteria of the American Academy of electrophysiological Medicine for needle EMG.

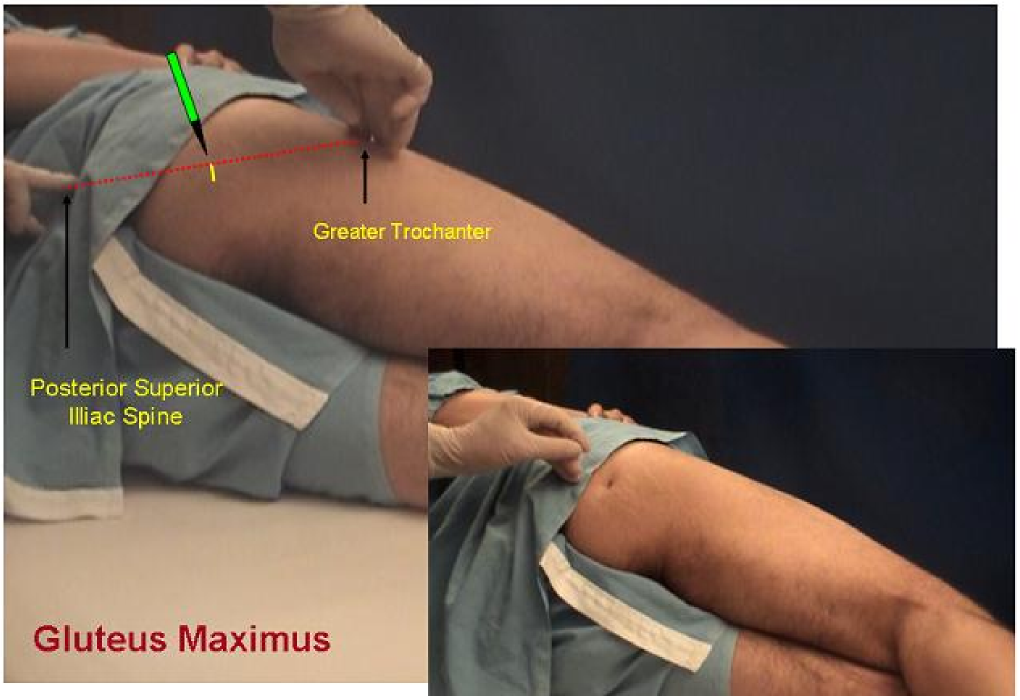
Rest and insertional activity was assessed first, followed by observations of the recruitment pattern and the motor unit action potential (MUAP).

Acute or ongoing denervation was diagnosed if there was increased insertional activity (>300 m/s), evidence of positive sharp waves, fibrillation potentials, complex repetitive discharges or other abnormal rest or insertional potentials. Ongoing denervation or re-innervation was determined by the morphology and amplitude, duration and firing pattern of the MUAP. A further needle EMG of the muscles was undertaken three months after operation.

Acute denervation potentials are not observed for at least three weeks after a nerve injury. An abnormal postoperative EMG in our study was recorded only if there had been a change in insertional activity or recruitment pattern of the MUAP or morphology from the preoperative examination.

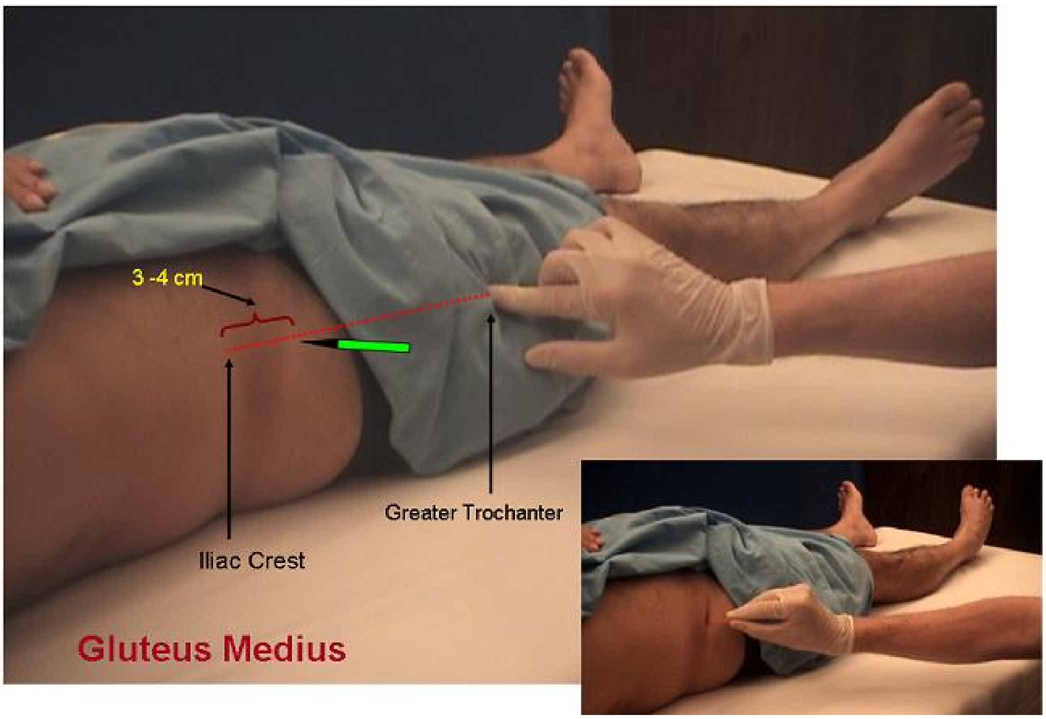
In this study we have done needle EMG of gluteus medius and maximus to assess whether it is normal or denervated following surgery.

FIGURE 8



Electromyography of Gluteus Maximus

FIGURE 9



Electromyography of Gluteus Medius

For Gluteus maximus the needle is inserted midway between greater trochanter and posterior superior iliac spine.For Gluteus minimus the needle is inserted 2.5 cm distal to the midpoint of iliac crest[7].

RADIOLOGICAL ASSESSMENT :

Anteroposterior pelvic and hip radiographs were taken preoperatively with the ankles 20 cm apart and the feet 15 degrees internally rotated. The femoral offset ratio was measured by a single observer from each radiograph. The femoral offset ratio was calculated by dividing the Femoral Offset by the distance between the centres of the bilateral femoral heads on radiographs. Both preoperative and postoperative measurements were taken.

Clinical records from hospital charts were evaluated for complications such as wound drainage, hematoma, dislocation, infection, deep venous thrombosis, pulmonary embolus,neurologic and vascular problems.

All variables in this study were entered into the database and computed using SPSS 11.0 for windows programme and were analyzed statistically, comparing the posterior approach patients with the Hardinge approach patients.

The statistical analysis involved comparing means of various parameters with resultant *p* values that are given with 95% confidence intervals.

RESULTS :

Total hip arthroplasties were performed in 23 patients of which 13 underwent Modified Hardinge[11] approach (cemented -3, uncemented -10) and 10 had posterior[29] approach (cemented – 4, uncemented- 6).The mean age was 45.39 years (22 – 75). The mean follow up was 117 days (93-151)

Preoperative and postoperative Harris Hip Score[16] were obtained to evaluate pain and function. There were significant differences between the lateral and posterior approach.

The mean preoperative Harris Hip Score was 44.62 in the lateral group whereas the mean preoperative Harris Hip Score in the posterior group was 32.70. The mean postoperative Harris Hip Score was 79.85 in the lateral group whereas the mean postoperative Score was 89.30 in the posterior group.(Table 1)

Overall the mean improvement in Harris Hip score[16] in the lateral group was 38.35 and in the posterior group 56.6.

TABLE:1

APPROACH			PRE_HHS	POS_HHS	PRE_TT	POST_TT
lateral	N	Valid	13	13	13	13
		Missing	0	0	0	0
	Mean		44.62	79.85	5.38	3.31
	Median		46.00	80.00	5.00	3.00
	Std. Deviation		9.553	6.902	.650	.947
	Range		40	24	2	3
	Minimum		23	66	4	2
	Maximum		63	90	6	5
posterior	N	Valid	10	10	10	10
		Missing	0	0	0	0
	Mean		32.70	89.30	5.70	2.80
	Median		32.50	91.00	6.00	3.00
	Std. Deviation		13.736	9.105	.483	.789
	Range		37	28	1	2
	Minimum		15	70	5	2
	Maximum		52	98	6	4

TABLE:2

APPROACH			PRE_GAIT	POS_GAIT	PRE_PAIN	POS_PAIN
lateral	N	Valid	13	13	13	13
		Missing	0	0	0	0
	Mean		23.77	9.00	19.23	38.46
	Median		24.00	8.00	20.00	40.00
	Std. Deviation		5.199	2.380	4.935	3.755
	Range		17	7	20	10
	Minimum		13	7	10	30
	Maximum		30	14	30	40
posterior	N	Valid	10	10	10	10
		Missing	0	0	0	0
	Mean		24.30	6.80	15.00	41.00
	Median		26.50	6.00	15.00	42.00
	Std. Deviation		5.478	2.741	5.270	4.346
	Range		18	9	10	14
	Minimum		13	3	10	30
	Maximum		31	12	20	44

TABLE:3

APPROACH			PRE_FN	POS_FN	PRE_OFFR	POS_OFFR
lateral	N	Valid	13	13	13	13
		Missing	0	0	0	0
	Mean		22.23	33.92	16.635	20.399
	Median		22.00	32.00	16.540	20.080
	Std. Deviation		5.403	4.232	3.1889	2.8675
	Range		21	13	12.2	10.7
	Minimum		10	29	9.9	16.8
	Maximum		31	42	22.1	27.5
posterior	N	Valid	10	10	10	10
		Missing	0	0	0	0
	Mean		13.90	40.80	17.167	21.918
	Median		15.00	43.00	16.700	23.310
	Std. Deviation		9.769	5.095	3.0969	3.0290
	Range		29	15	9.1	10.0
	Minimum		0	33	12.8	15.6
	Maximum		29	48	21.9	25.6

Mean Pain scores before surgery were 19.23 for lateral and 15 for posterior groups. After surgery pain score were 38.46 for lateral and 41 for posterior groups(Table 2).Mean Function scores preoperatively were 22.23 for lateral and were 13.9 for posterior groups. Postoperative function score were 33.9 for lateral and 40.8 for posterior(Table 3). Post operative assessment were done at the end of 3 months.

The mean improvement in pain in lateral group were 20.28 and in the posterior group were 26.The p value for Harris Hip score was .004 which is significant. The p value for the pain score was .042 and for the function score was .001 both of which are significant.When compared with the preoperative hip scores ,significant improvement was appreciated in the posterior group when compared to lateral group.

Evaluation of gait was performed at the end of 3 months postoperatively.

The mean preoperative score was 23.77 for lateral and were 24.3 for posterior groups. Postoperatively the score were 9.0 for lateral and were 6.8 for posterior groups.The overall mean improvement in gait in the lateral group was 14.77 and 17.5 for the posterior group. Although ,there is more improvement in the posterior group than the lateral ,the p value was .115 which is not significant.

Lateral group continued to have a slightly higher proportion of patients with limp. However, the difference is not statistically significant.

Preoperative Trendelenburg test mean score was 5.38 for the lateral group and 5.7 for the posterior group. The postoperative score was 3.31 for the lateral and 2.8 for the posterior groups.The mean improvement in the test was 2.07 for the lateral and 2.9 for the posterior group. Although, there is more improvement in the posterior group than the lateral, the p value was .131, which is not significant.

TABLE:4

	IMP_HHS	IMP_PAIN	IMP_FUNC
Mann-Whitney U	22.500	35.000	17.000
Wilcoxon W	127.500	140.000	122.000
Z	-2.784	-2.167	-3.113
Asymp.(2 tailed)	.005	.030	.002
ExactSig.[2*(1 tailed Sig.)]	.004	.042	.001

Inference: There is significant improvement in Harris hip score ,pain and function score in the posterior group compared to the lateral group.

Electrophysiologial study was normal both preoperatively and postoperatively in both groups and hence not significant.

The mean preoperative offset ratio in the lateral group was 16.635 and in the posterior group it was 17.167. The postoperative offset ratio in the lateral group was 20.399 and in the posterior group it was 21.918. The p value was .446 and hence the improvement in offset is not significant.

TABLE:5

	IMP_TT	IMP_GAIT	IMP_OFFR
Mann-Whitney U	40.000	39.500	52.000
Wilcoxon W	131.000	130.500	143.000
Z	-1.607	-1.587	-.806
Asymp.(2 tailed)	.108	.113	.420
ExactSig.[2*(1 tailed Sig.)]	.131	.115	.446

Inference : There is no significant difference in Trendelenburg test and gait between lateral and posterior approach.

TRENDELENBURG TEST AND GAIT IN RELATION TO FEMORAL OFFSET RATIO :

The Trendelenburg test and gait were correlated in relation to the offset ratio. 9 patients who had postoperative offset ratio of less than 20% had a mean postoperative Trendelenburg score of 3.89 and gait score of 10.33.

14 patients who had postoperative offset ratio of more than 20 % had a mean postoperative Trendelenburg score of 2.57 and gait score of

6.57.The p value for gait and Trendelenburg test in relation to femoral offset ratio were .001 and .001 respectively which is significant.

TABLE:6

Categorized			POST_TT	POS_GAIT
< 20	N	Valid	9	9
		Missing	0	0
	Mean		3.89	10.33
	Median		4.00	11.00
	Std. Deviation		.601	2.345
	Range		2	7
	Minimum		3	7
	Maximum		5	14
>= 20	N	Valid	14	14
		Missing	0	0
	Mean		2.57	6.57
	Median		2.50	7.00
	Std. Deviation		.646	1.785
	Range		2	7
	Minimum		2	3
	Maximum		4	10

Inference : In patients with femoral offset ratio < 20 % ,the mean postoperative Trendelenburg and gait score were 3.89 and 10.33 respectively whereas with offset ratio > 20% the score were 2.57 and 6.57 respectively.

TABLE:7

	IMP_TT	IMP_GAIT
Mann-Whitney U	11.000	13.000
Wilcoxon W	116.000	118.000
Z	-3.447	-3.202
Asymp.(2 tailed)	.001	.001
ExactSig.[2*(1 tailed Sig.)]	.001	.001

Inference : There is significant difference in Trendelenburg test and gait in relation to femoral offset ratio.

CEMENTED Vs UNCEMENTED:

Of the 23 patients ,16 patients underwent uncemented total hip replacement and 7 patients underwent cemented hip replacement.The Trendelenburg Test,gait and Harris hip score were compared between the 2 groups and the p value was .820,.579 and .720 respectively.The value is not statistically significant.

TABLE:8

		Prosthesis		Total
		Uncemented	Cemented	
APPROACH	Lateral	10	3	1
	Posterior	6	4	1
Total		16	7	2

TABLE:9

Statistics

Prosthesis			POST_TT	POS_GAIT	POS_HHS
Uncemented	N	Valid	16	16	16
		Missing	0	0	0
	Mean		3.06	8.25	83.44
	Median		3.00	7.50	84.00
	Std. Deviation		.998	2.933	8.922
	Range		3	11	32
	Minimum		2	3	66
	Maximum		5	14	98
Cemented	N	Valid	7	7	7
		Missing	0	0	0
	Mean		3.14	7.57	85.14
	Median		3.00	7.00	84.00
	Std. Deviation		.690	2.299	10.123
	Range		2	7	28
	Minimum		2	5	70
	Maximum		4	12	98

TABLE:10

Mann-Whitney Test

	POS_GAIT	POST_TT	POS_HHS
Mann-Whitney U	47.500	52.000	50.500
Wilcoxon W	75.500	188.000	186.500
Z	-.577	-.281	-.368
Asymp. Sig. (2-tailed)	.564	.779	.713
Exact Sig. [2*(1-tailed Sig.)]	.579[a]	.820[a]	.720[a]

a. Not corrected for ties.

b. Grouping Variable: prosthesis

<u>Inference:</u> There is no significant difference in gait ,Trendelenburg test and Harris hip score between cemented and uncemented hips.

MALE Vs FEMALE:

The Trendelenburg test ,gait and Harris hip score were compared postoperatively between male and female patients. 0f the 23 patients,17 were male and 6 were female. The p value was not significant and hence there was no significant difference with regards to the sex postoperatively.

TABLE:11

Statistics

SEX			POST_TT	POS_GAIT	POS_HHS
Male	N	Valid	17	17	17
		Missing	0	0	0
	Mean		3.06	7.82	83.24
	Median		3.00	7.00	83.00
	Std. Deviation		.899	2.325	9.052
	Range		3	9	32
	Minimum		2	5	66
	Maximum		5	14	98
Female	N	Valid	6	6	6
		Missing	0	0	0
	Mean		3.17	8.67	86.00
	Median		3.50	10.00	87.50
	Std. Deviation		.983	3.830	9.778
	Range		2	9	28
	Minimum		2	3	70
	Maximum		4	12	98

Mann-Whitney Test TABLE:12

Test Statistics[b]

	POS_GAIT	POST_TT	POS_HHS
Mann-Whitney U	41.000	46.500	37.500
Wilcoxon W	194.000	199.500	190.500
Z	-.712	-.332	-.946
Asymp. Sig. (2-tailed)	.477	.740	.344
Exact Sig. [2*(1-tailed Sig.)]	.516[a]	.759[a]	.354[a]

a. Not corrected for ties.

b. Grouping Variable: SEX

Inference : There is no significant difference in gait ,Trendelenburg test and Harris hip score between male and female postoperatively.

Since we had no cases of infection (superficial or deep) , dislocation , heterotropic ossification ,nerve injuries,deep vein thrombosis and pulmonary embolism clinically , there was no significant difference in these two groups with regards to complications.

DISCUSSION :

Surgical exposure is fundamental to the end result in hip arthroplasty.

Many surgical approaches are used in total hip replacement. Two of the most popular are the posterior[29] and the lateral [11](Modified Hardinge type) approaches. We studied these since they are the two most commonly performed approaches and both provide adequate exposure for total hip replacement.

The relative merits of these approaches are debated, although no study has conclusively demonstrated an advantage of one over the other. The issues involved in selecting a surgical approach are addressed in this study.

The posterior approach is generally considered to be easy to perform, using less extensive tissue dissection, which gives shorter operation times, and less blood loss. It allows a good exposure of the femur that may reduce the risk of femoral fracture during the procedure. It is considered to be associated with less problems with gait since the abductor muscles are not dissected. However, it is often more difficult to see the acetabulum and increased rates of dislocation have been reported

[45](Woo 1982; Paterno 1997; Li 1999). It also has higher incidences of sciatic nerve injury and femoral stem loosening[37].

The advantages proposed for the direct lateral approach are that it allows good exposure of the acetabulum, facilitating cup positioning which may decrease rates of hip dislocation. It also diminishes the risk of injury to the sciatic nerve, which is not close to the operative field. However, there is an increased risk of damage to the superior gluteal nerve[2] as well as to the gluteus medius muscle resulting in delay in recovery of abductor strength and late Trendelenburg gait. Also, the supine position provides excellent exposure to the acetabulum, allows exact acetabular orientation and direct limb length measurement. Further more, the capsule of the hip joint is preserved. Though not confirmed statistically, there is a likelihood of heterotropic ossification with this approach.

The primary goal of total hip arthroplasty is to improve pain and function. Barber[3] in 1996 compared 28 total hip replacement operated on using the posterior approach versus 21 hips using the direct lateral approach. Cemented and uncemented implants were used in both approaches in different proportions. At 2 years follow-up, no dislocations were recorded in either group. A Trendelenburg test score as well as a limp score and an abductor power score were recorded without significant

FIGURE 10

POSTERIOR APPROACH

FIGURE 11

POSTERIOR APPROACH

FIGURE 12

Posterior approach - Postoperative

differences between groups. This is the only study which assessed Harris hip score and found both groups improved their postoperative score to obtain the same mean score of 94 at the end of 2 years and found it is not significant.

In this study we used Harris hip score to evaluate the preoperative and postoperative outcome. We assessed at the end of 3 months for comparing the early functional outcome between the lateral and posterior approaches. Though there is a significant improvement in the overall score as well as individual pain and functional score, it is of doubtful significance.

The number of cases of Ankylosing Spondylitis however can explain this significant difference between the 2 groups. Active disease being more in the patients operated by the lateral approach. This may have been remedied had the two groups been matched. Hence it is not significant.

Mulliken[31] et al. (1998), in a review of 770 total hip replacements via the lateral approach, found a 10% incidence of moderate or severe limp at 2 years, but there was no comparative posterior approach group.

Baker and Bitounis[2] (1989) found more positive postoperative Trendelenburg tests after the lateral approach than after the posterior one and considered that this weakness was due to detachment of the gluteal flap, although they did not quantify abductor strength. In addition, violation of the ‘safe zone’ [8](Comstock et al. 1994) within 5 cm of the greater trochanter may damage the superior gluteal nerve and thus further risk of abductor muscle weakness[35] (Ramesh et al. 1996, Baker and Bitounis 1989).

However, the role of nerve injury in the production of postoperative abductor weakness is not clear as Kenny[19] et al. (1999) found that EMG evidence of acute nerve injury does not correlate with the clinical findings of weak abduction.

The presence of a postoperative Trendelenburg gait was studied by Baker[2] 1989, Barber[3] 1996 and Downing[9] 2001. These indicate no significant difference between posterior versus direct lateral surgical approach.

In our prospective study of the two approaches, we found postoperative Trendelenburg test slightly seems to favour posterior group but statistically insignificant. However, the results should be taken with care as all the patients were not compared at the same follow-up times. We have also been unable to show any significant difference in results of the Trendelenburg test between the two approaches.

FIGURE 13

Postoperative follow up

Lateral approach

FIGURE 14

Postoperative follow up - Lateral

FIGURE 15

Lateral Approach

Nerve palsy or injury was studied by Baker[2] 1989 and Weale[44] 1996.Weale[44] compared 22 participants operated on by the posterior approach to 20 operated on by the direct lateral one. Incidence of nerve injury (sciatic, obturator, femoral nerves) was reported at 4 weeks from operation. He used electromyographic study. Baker observed only superior gluteal nerve palsies. A significant difference between posterior versus direct lateral surgical approach was found in favour of less nerve injuries with the posterior approach However, when looking at each type of nerve palsy separately, no significant difference was found between each type of surgical approach.

Since there is no case reported with nerve injuries in our study and as the preoperative and postoperative electromyographic study is also normal ,there is no significance in the incidence of nerve injury between the two groups.

Downing [10]2001 compared 49 total hip arthroplasties done by the posterior approach versus 51 hips by the direct lateral approach for 100 participants. All participants had cemented stems, but the type was different in each group. Follow-up was done at 3 and 12 months. Twenty seven participants were lost to follow-up.Four participants had a hip dislocation, 1/49 (2.0%) in the posterior approach group versus 3/51 (5.9%) in the direct lateral approach group. The difference was not statistically significant between the groups .Trendelenburg tests were reported at 12months from surgery without difference between groups .

There were no dislocation in both the groups in our study.

Our study is the only study which assessed gait visually using the Rivermead visual gait assessment form for comparing the gait following total hip replacement. Though there is a slight improvement in the posterior group compared to the lateral ,the p value is .108 which is insignificant.

It is also found that in this study there is significant correlation between the femoral offset ratio and the Trendlenburg test and gait. If patients Femoral Offset ratio was greater or equal to 20% following total hip arthroplasty surgery, they were more likely to show a negative Trendelenburg sign. To obtain an femoral offset of greater than or equal to 20%, surgeons needed to further medialise the acetabular cup and use long neck components during Total Hip Arthroplasty. Likewise, the reconstructed hip joint position is crucial to improving hip abductor function.

To our knowledge, Our study is the only prospective study comparing the Harris hip score,Trendelenburg test ,gait analysis and electromyography all together in a single study .

LIMITATIONS :

There are a few limitations in our study namely

1. It is not randomized and not double blinded.
2. Power of the study is inadequate.
3. Selection bias – patients in both groups are not matched.
4. Short term follow up .
5. Implant used is not the same in all patients .

CONCLUSION :

It is clear from this study that one can obtain equally good results with total hip arthroplasty using either the lateral approach or the posterior approach. The good results in both groups may be due to the experience of the surgeons who performed their usual approach—an advantage of the ‘randomisation by surgeon’ protocol. From this study the functional outcome ,gait and Trendelenburg test are equally good in both lateral and posterior approach and it is also clear that femoral offset affects the Trendelenberg test and the gait pattern.

Clearly, postoperative abductor weakness has many causes and we believe good surgical technique and awareness of the anatomy of the nerve supply are key factors in preserving good abductor strength.

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APPENDIX :

PROFORMA FOR THR

NAME :

AGE :

SEX :

OCCUPATION :

ADDRESS :

PHONE :

HISTORY:

DIAGNOSIS :

CHARNLEY'S CLASS :

SIDE :

DOS :

PROCEDURE :

APPROACH :

ADDITIONAL PROCEDURE:

POSTOP :

HARRIS HIP SCORE

	PREOP	AFTER 3 MONTHS
PAIN		
LIMP		
SUPPORT		
DISTANCE WALKED		
STAIRS		
SHOES & SOCKS		
SITTING		
PUBLIC TRANSPORTATION		
DEFORMITY		
ROM		
FLEXION		
ABDUCTION		
ADDUCTION		
ER IN EXTENSION		
IR IN EXTENSION		
TOTAL		

	PREOP	POSTOP
GAIT		
TRENDELENBURG TEST		
TRUE SHORTENING		
EMG		
Gluteus Maximus		
Gluteus Medius		
IMPLANT		

Harris Score for Evaluating Arthritis of the Hip

Parameter	Finding	Points
Pain	none, or ignores it	44
	slight, occasional, no compromise in activities	40
	mild pain, no effect on average activities, rarely moderate pain with unusual activity, may take aspirin	30
	moderate pain, tolerable but makes concessions to pain; some limitations of ordinary activity or work; may require occasional pain medicine stronger than aspirin	20
	marked pain with serious limitation of activities	10
	totally disabled, crippled, pain in bed, bedridden	0

Class	Parameter	Finding	Points
gait	limp	None	11
		Slight	8
		Moderate	5
		Severe	0
	support	None	11
		cane for long walks	7
		cane most of the time	5
		one crutch	3
		two canes	2
		two crutches	0
		not able to walk	0
	distance walked	Unlimited	11
		6 blocks	8
		2-3 blocks	5
		indoors only	2
		bed and chair	0
Activities	stairs	normally without using railing	4
		normally using a railing	2
		in any manner	1
		unable to do stairs	0
	shoes & socks	with ease	4
		with difficulty	2
		Unable	0
	sitting	comfortably in ordinary chair one hour	5
		on a high chair for one-half hour	3
		unable to sit comfortably in any chair	0
	enter public transportation		1

Degree of Motion	Range	Values	Index Factor
Flexion	0 - 45°	0 - 45	1.0
	45 - 90°	0 - 45	0.6
	90-110°	0 - 20	0.3
Abduction	0-15°	0 - 15	0.8
	15-20°	0 - 5	0.3
	> 20°		0
external rotation in extension	0-15°	0 - 15	0.4
	> 15°		0
internal rotation in extension	any		0
Adduction	0-15°	0 - 15	0

overall rating for range of motion =

= (SUM ((value) * (index factor))) * 0.05

Trendelenburg Test	Record As:
	positive
	level
	neutral

Harris score =

= (pain value) + (limp value) + (support value) + (distance walked value) + (stairs value) + (shoes value) + (sitting value) + (public transportation value) + (absence of deformity value) + (range of motion value)

Interpretation:

• maximum points 100 (pain 44, function 47, absence of deformity 4, range of motion 5)

• goal is to have a value as close to 100 as possible

TRENDELENBURG TEST

1 – Normal: If the pelvis on the nonstance side can be elevated high up and is maintained for 30 seconds

2 – Elevation of the pelvis is present but not maximal

3 – Pelvis is elevated but not maintained for 30 seconds

4 – No elevation of the pelvis on the nonstance side

5 – Drooping of the pelvis

6 – Nonvalid response : presence of hip pin, uncooperative patient.

In this study, responses 1 and 2 were considered normal. The Trendelenburg test was positive when the response to the test was 3, 4, or 5.

Appendix 1 – The Rivermead Visual Gait Assessment form

Patient:____________________

Scoring: 0 = normal **Deviations:** 1 = mild 2 = moderate 3 = severe (please circle)

Upper Limb Position

1	Shoulder Depressed/Retracted/Elevated					0	1	2	3
2	Elbow flexed ≤45° (=**0**) 45° to 90° (=**1**) >90° (=2)					0	1	2	

Stance Phase *For trunk deviations,* 0 *= midline*

3	Trunk flexed/extended		3	2	1	0	1	2	3
		Inclined:	backward ←					→ forward	
4	Trunk side flexed		3	2	1	0	1	2	3
		Direction:	left ←					→ right	
5	Trunk and pelvis: lateral displacement		3	2	1	0	1	2	3
		Amount:	excessive ←					→ reduced	
6	Contralateral drop pelvis					0	1	2	3

7	Hip extension decreased		0	1	2	3
8		*with backward rotation*	0	1	2	3
9A	Knee **flexion** excessive:	*at initial contact*	0	1	2	3
10A		*throughout range*	0	1	2	3
		or				
9B	Knee **extension** excessive:	*at initial contact*	0	1	2	3
10B		*throughout range*	0	1	2	3

11A	Ankle in excess **plantar** flexion				0	1	2	3
	or							
11B	Ankle in excess **dorsi** flexion				0	1	2	3
12	Inversion excessive				0	1	2	3
13	Plantar flexion decreased at toe-off				0	1	2	3

Swing Phase *For trunk deviations, 0 = midline*

14	Trunk flexed	3	2	1	0	1	2	3
	Direction:	backward						forward
15	Trunk side flexed	3	2	1	0	1	2	3
	Direction:	left						right
16	Hike pelvis (elevation)				0	1	2	3
17	Backward rotation pelvis				0	1	2	3
18	Decreased hip flexion				0	1	2	3
19	Decreased knee flexin				0	1	2	3
20	Ankle in excess plantar flexion				0	1	2	3

Any other deviations noted.. 0 1 2 3

.... 0 1 2 3

Reference limb_________________

Walking aid_________________

AFO_________________

Total score ______________/59 **Date**______________________

Rivermead Visual Gait Assessment: guidelines

Because the descriptor terms 'mild, moderate and severe' cannot be strictly quantified, interpretation of their meaning will depend in part upon the clinician's own process of gait analysis. The notes overleaf refer to the components of normal gait, and may be useful as a guide when considering the deviations.

Shoulder depressed/retracted/elevated

The posterior border of the scapular lies approximately 25 mm from, and almost parallel with, the thoracic vertebrae between the levels of T1–T8.

Elbow flexed

The elbow flexes to approximately 8° during stance.

Trunk flexed and side flexed

During both stance and swing phases the trunk is erect and rotates about the vertical axis.

Trunk and pelvis lateral displacement

The trunk and pelvis displace laterally approximately 25 mm during stance, towards the stance leg.

Contralateral pelvis drop

During midstance the pelvis dips only a few degrees on the opposite side, its position maintained by contraction of the hip abductors on the stance side.

Hip extension

During midstance and terminal stance the hip moves from 30° flexion to 0° (20° apparent hyperextension if the angle from hip to ankle is considered).

Backward hip rotation

The pelvis moves from 5° forward rotation at initial stance to 5° backward rotation at terminal stance.

Knee flexion/extension at initial contact

The knee is in a neutral position at initial contact and during mid and terminal stance. The yield of the knee is 15°, and occurs during the loading response just after initial contact.

Ankle plantar/dorsiflexion

The ankle moves from neutral to 10° plantar flexion before midstance when the position changes to 10° dorsiflexion, as the leg moves forward over the foot.

Inversion

The foot moves from slight inversion/supination on initial stance to eversion/pronation which is maintained until heel-off when the foot is again supinated.

Plantar flexion decreased at toe-off

The ankle provides the push-off required at preswing by moving from dorsiflexion to 10° plantar flexion.

Hike pelvis

The pelvis is slightly lower on the leg during the swing phase, thus lowering the height of the hip joint.

Backward rotation pelvis

By terminal swing the pelvis is in 5° forward rotation.

Hip flexion

The hip flexes throughout the range from 0° at initial swing to reach a peak at 60–70°, before dropping to 25° at terminal swing.

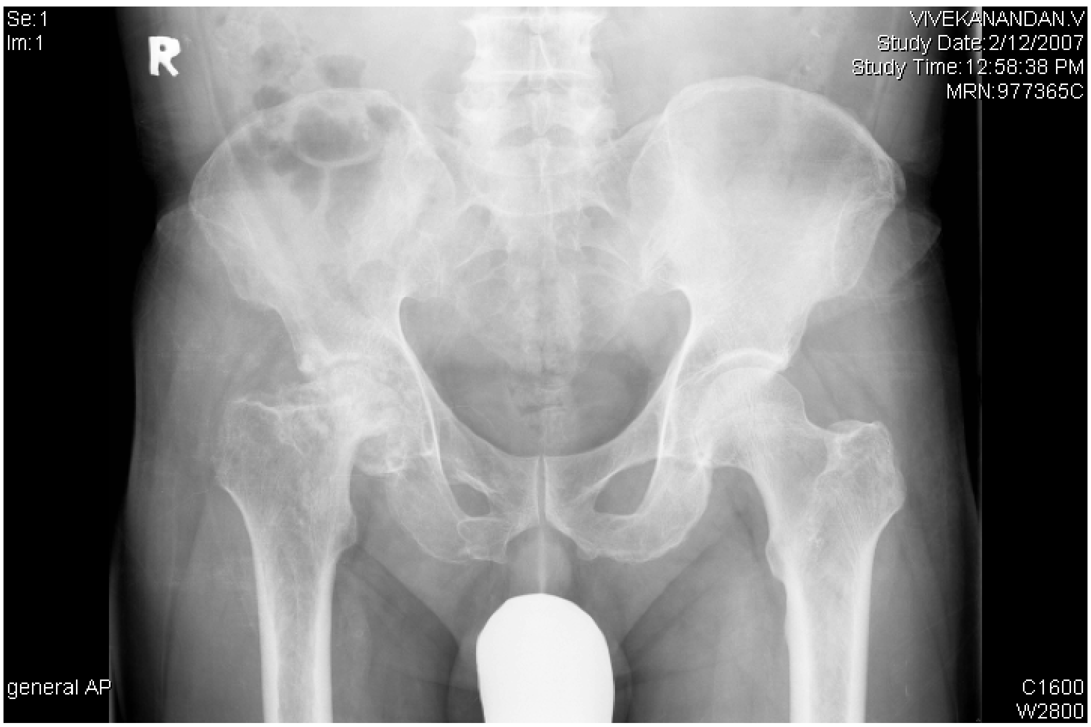
Knee flexion

The knee flexes from 40° at preswing to 60° during midswing.

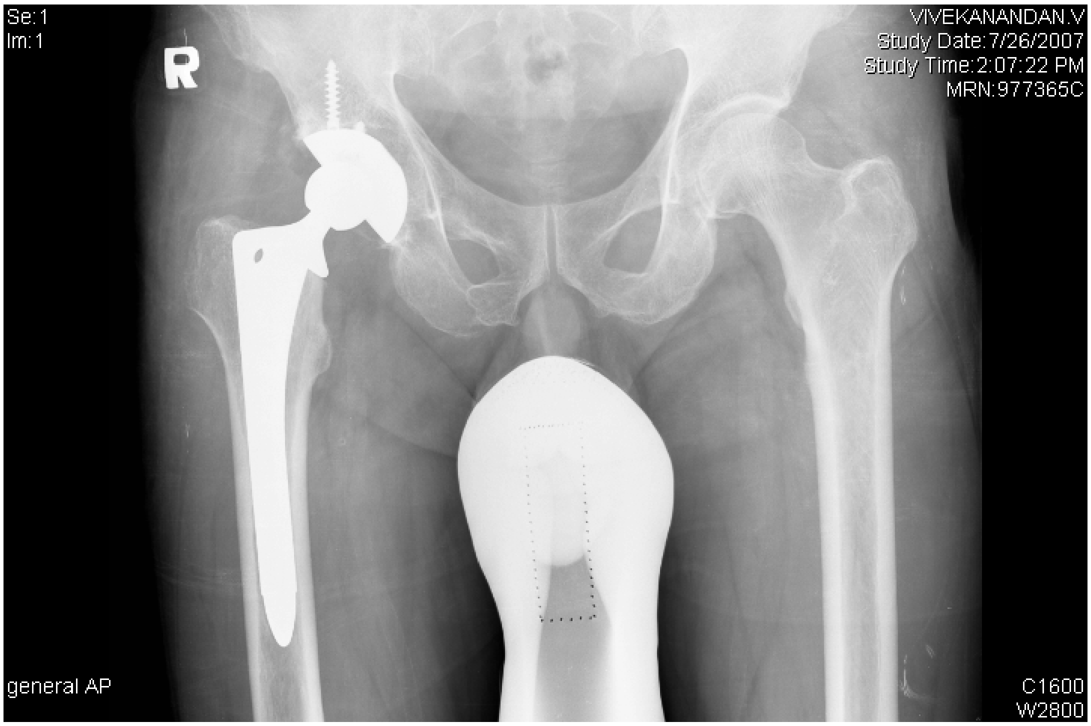
Plantar flexion

The ankle moves from plantar flexion to neutral by midswing to clear the ground by approximately 14 mm, and stays in neutral until the loading response during stance.

Lateral approach – Preop XRay

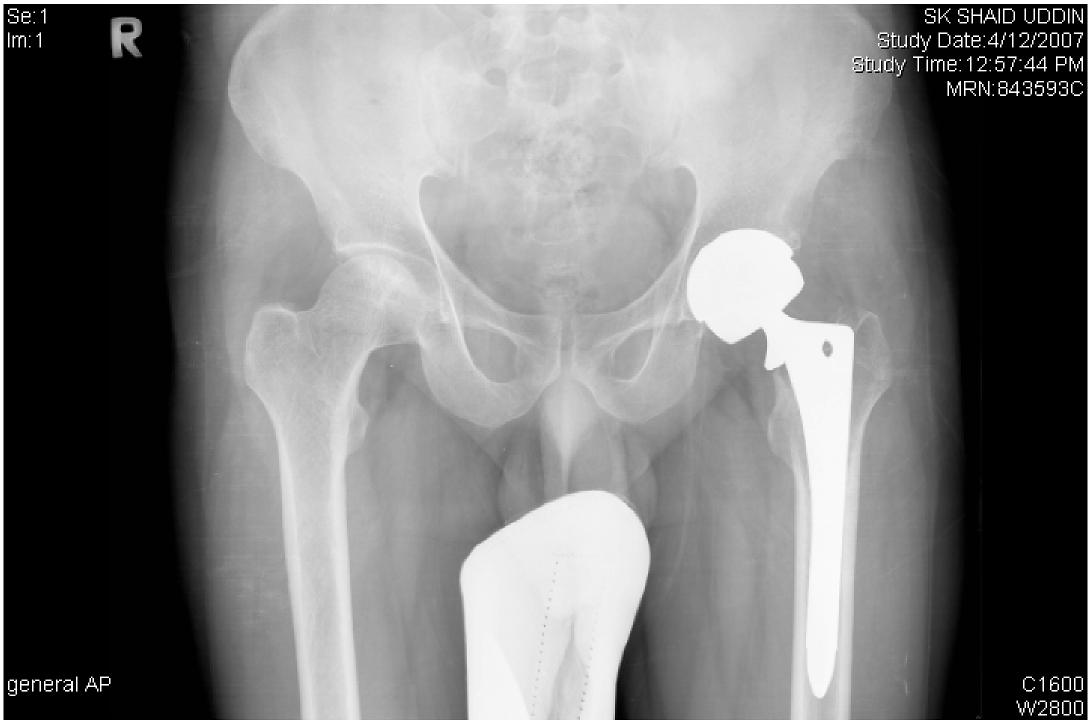


Lateral approach - Preoperative X Ray



Lateral approach – Postoperative X Ray

Posterior approach – Preoperative X Ray



Posterior approach – postoperative Xray
(3 Months)

P